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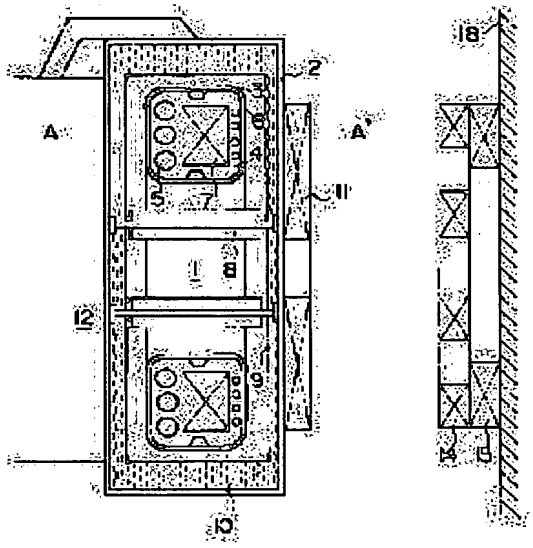
(54) SUPERCONDUCTING MAGNET FOR MAGNETIC LEVITATION TRAIN HAVING INDUCTION COLLECTOR COIL

(57)Abstract:
PROBLEM TO BE SOLVED: To stably supply power using electromagnetic induction between a superconducting magnet for magnetic levitation train and a levitation coil and a propulsion coil which are located on the ground and maintain a stable superconducting state for obtaining levitation and propulsion.
SOLUTION: On the surface of an outer container 2 of a superconducting magnet 1, located on a vehicle so as to face a levitation coil 14 and a propulsion coil 15 located on the ground, an induction collector coil 11 is so fixed as to face the levitation coil 14. In an inner container 3 holding a superconducing coil 7 in a refrigerant, a superconducting coil 7 is fixed, off-centered to a wall face of the outer container 2 to which the collector coil 11 fixed. For refrigerant through-holes formed in a spacer metal fittings 4 for fixing the superconducting coil 7 in the inner container 3, those formed to the induction collector coil 11 side are made small and those formed to the opposide side, that is, to the truck side are made large. Furthermore, part of a spacer metal fitting 4 near the induction collector coil 11 is formed thicker than the other side of the spacer.



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CLAIMS

[Claim(s)]
[Claim 1] In the super-conductive magnet for maglev trains which counters the surfacing coil and promotion coil which were installed on the ground coming [the outside tub which carries out the interior of the inner lift which holds a superconduction coil in a refrigerant, and this inner lift], and is installed in a car While the induction current collection coil is being fixed to the field which counters said surfacing coil of said outside tub The super-conductive magnet for maglev trains which has the induction current collection coil characterized by for said superconduction coil carrying out eccentric contiguity to the outside tub side face in which said induction current collection coil was fixed, and fixing it to it within said inner lift.
[Claim 2] It is the super-conductive magnet for maglev trains which has the induction current-collection coil according to claim 1 which the superconduction coil is being fixed in the inner lift by the location which carried out eccentricity to the induction current-collection coil side within the inner lift by the tabular spacer metallic ornaments arranged at the radial, and is characterized by for an induction current-collection coil side to be small, and to process the refrigerant passage hole of the opposite side greatly in the refrigerant passage hole of these spacer metallic ornaments on both sides of an induction current-collection coil side and a superconduction coil.
[Claim 3] The super-conductive magnet for maglev trains which has the induction current collection coil according to claim 2 characterized by making board thickness of the spacer metallic ornaments by the side of induction current collection coil close attendants thicker than the board thickness of the opposite side on both sides of a superconduction coil an induction current collection coil side.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the super-conductive magnet for maglev trains which has the induction current collection coil with which maintenance of a stable electric power supply and a superconducting state is attained, securing the surfacing force for the case where power is collected from a ground side to a train side, using the electromagnetic-induction phenomenon between the surfacing coil by the side of the super-conductive magnet for maglev trains, and the ground, and a promotion coil.
[0002]
[Description of the Prior Art] Structure as conventionally shown in drawing 3 is adopted as the super-conductive magnet used for a maglev train. Drawing 3 is the sectional view of a super-conductive magnet 1. The super-conductive magnet 1 of illustration The superconduction coil 7 and the inner lift 3 of the shape of a doughnut which carries out the interior of the superconduction coil 7, The tabular metallic ornaments 16 which carry out support immobilization of the superconduction coil 7 at the wall of an inner lift 3, and the outside tub 2 which holds an inner lift 3, It is constituted including the load supporting material 8 which carries out fixed support of the inner lift 3 at the core of the outside tub 2, the heat insulator 10 with which it was equipped all over the inner circle wall of the outside tub 2, and the nitrogen shielding plate 9 attached so that the inner skin of this heat insulator 10 might be covered. The refrigerant for cooling the superconduction coil 7 in the inner lift 3 interior is filled, and the refrigerant passage hole 5 is formed in the metallic ornaments 16 arranged at the radial at the doughnut-like inner lift 3.
[0003] Moreover, there is a thing of a JP,8-280102,A official report indication as a conventional example of the current collector of the maglev train which collects power on a train from the ground during train transit using the electromagnetic-induction phenomenon produced between the surfacing coil and promotion coil which have been arranged at the ground side, and the superconduction coil on a train, and this is explained using drawing 5 and drawing 6 . As first shown in drawing 5 , a car body 17 is carried in a truck 12, a truck 12 carries out surfacing transit in accordance with an orbit 26, and the side attachment wall 18 is formed in the both sides of an orbit 26. The promotion coil 15 is formed along the truck 12 of each side attachment wall 18, and the field which counters, the 1st surfacing coil 19 is arranged at the truck of the promotion coil 15, and the side which counters, and the 2nd surfacing coil 20 is arranged at the 1st surfacing coil 19 bottom. In the both-sides side of a truck 12, the superconduction coils 21a-21d for current collection are arranged along the travelling direction of a train so that it may counter with the 1st surfacing coil 19.
[0004] Drawing 6 is the cross-section side elevation seen from the side-attachment-wall 18 side of drawing 5 , and since the height of the vertical direction of the supporter material 24 becomes large by attaching in the plate-like supporter material 24 which attached the superconduction coils [for current collection / 21a-21d] cryostat 23, and the current collection coils 22a-22l. in the truck 12, its rigidity of the supporter material 24 improves. For this reason, since vibration of a cryostat 23 is controlled and generation of heat by friction with the superconduction coils 21a-21d for current collection, the superconduction coil 25 for surfacing promotion, and a cryostat 23 is reduced, evaporation of liquid helium can be lessened.
[0005]
[Problem(s) to be Solved by the Invention] Although the current collector of the maglev train shown in drawing 5 and drawing 6 is mainly a system for the electric power supply of the lighting inside a car, air-conditioning, and mounted helium refrigerator and is considered for a stable electric power supply to be possible also in the

system of drawing 5 and drawing 6 , it is applying these systems to a maglev train, and can consider producing the following problems.
[0006] : ** In the coil which constitutes the current collection system in drawing The superconduction coils 21a-21d (upper part) for current collection made to generate electromagnetic field between the 1st surfacing coil 19 and the 2nd surfacing coil 20, And since there are current collection coils 22a-22l. (lower part) which collect a current using the electromagnetic field then generated, this could be superficially shifted in the same part and it arranges The anchoring part of the current collection coil of only current collection is restricted, and the power supplied to in the car may be unable to supply in one system.
[0007] ** : by carrying to a car the system which performs **, the weight of a car increases and cause reduction of a transportation number of passengers.
[0008] The purpose of this invention holds the stable superconducting state, and is to offer the super-conductive magnet for maglev trains which has the induction current collection coil which can be run while it secures the space in which an outside tub front face is brought close to which centering on a coil, and an induction current collection coil can be installed, in order to solve such a problem.
[0009]
[Means for Solving the Problem] It carries out eccentric contiguity and fixes to the outside tub side which fixes said current-collection coil in the inner lift which holds a superconduction coil in a refrigerant while it counters said coil and fixes an induction current-collection coil to this tub front face outside a super-conductive magnet in the super-conductive magnet for maglev trains which counters the surfacing coil and the promotion coil which were installed in the ground side, and is installed on a vehicle, in order that this invention may make this purpose attain. Moreover, an induction current collection coil side is small, and the truck side by the side of reverse processes greatly the refrigerant passage hole of the spacer metallic ornaments inside said super-conductive magnet which carried out eccentric contiguity. Furthermore, the board thickness of the spacer metallic ornaments by the side of the induction current collection coil close attendants who processed the refrigerant passage hole small is processed thickly.
[0010]
[Embodiment of the Invention] One example of the super-conductive magnet for maglev trains concerning this invention is explained using drawing 1 . In a maglev train, a current is collected using the electromagnetic-induction phenomenon which the power for lighting in the car, air-conditioning, mounted helium refrigerator, etc. is running. The inner lift 3 of the shape of a doughnut to which the super-conductive magnet for maglev trains of illustration carries out the interior of the superconduction coil 7 and the superconduction coil 7, The tabular spacer metallic ornaments 4 which carry out support immobilization of the superconduction coil 7 at the wall of an inner lift 3, The outside tub 2 attached in the side face which carries out the interior of the inner lift 3, and counters the side attachment wall 18 of a truck 12, The load supporting material 8 which carries out fixed support of the inner lift 3 at the core of the outside tub 2, and the heat insulator 10 with which it was equipped all over the inner circle wall of the outside tub 2, The nitrogen shielding plate 9 attached so that the inner skin of this heat insulator 10 might be covered, It is constituted including the induction current collection coil 11 fixed to the side face of the outside tub 2 which counters the surfacing coil 14 and the promotion coil 15 which are installed in a side attachment wall 18, and the superconduction coil 7 and the induction current collection coil 11 level the medial-axis line of a coil mostly, and are arranged. It is fixed through the spacer metallic ornaments 4 in an inner lift 3, and the superconduction coil 7 which the super-conductive magnet 1 interior of a car-body 17 side (truck 12 side) has in a superconducting state is supported using the load supporting material 8 in the outside tub 2 interior an inner lift 3 has the interior in a vacua. Moreover, since the outside tub 2 interior produces the temperature gradient which attains to 4.2K from a room temperature, the nitrogen shielding plate 9 and the heat insulator 10 are formed. Next, the surfacing coil 14 is attached in the location which counters the outside tub 2 at the side to which the promotion coil 15 counters a tub 2 outside the promotion coil 15, respectively, and the side attachment wall 18 by the side of the ground is made to generate surfacing and driving force required for transit in the superconduction coil 7 by the side of a car body 17 (truck 12 side). Therefore, since spacing of the surfacing coil 14 and the superconduction coil 7 and spacing of a promotion coil and the superconduction coil 7 generate surfacing and driving force, they are not desirable. [of exceeding a predetermined distance]
[0011] For this reason, in order that the structure of the super-conductive magnet 1 interior may secure the

space which sets said surfacing coil 14 and predetermined spacing, and installs the induction current collection coil 11 between said surfacing coil 14 of the outside tub 2, the field which counters, and said surfacing coil 14, from said side attachment wall 18, said surfacing coil 14 of the outside tub 2 and the field which counters keep a necessary distance, and is arranged. On the other hand, to the wall surface side of the outside tub 2 to which the above-mentioned induction current collection coil 11 is being fixed, within the inner lift 3, eccentric contiguity is carried out and the superconduction coil 7 is arranged so that distance of each coil currently installed in the side attachment wall 18 and the superconduction coil 7 dedicated in the inner lift 3 may not be enlarged.

[0012] In the spacer metallic ornaments 4 which fix to the inside wall of an inner lift 3 the superconduction coil 7 which has been arranged in the above-mentioned inner lift 3 at the radial, and carried out eccentric contiguity at the side-attachment-wall 18 side, moreover, the liquid passage hole through which a refrigerant passes The refrigerant passage hole a5 by the side of the truck 12 which is small and is on the reverse side about the refrigerant passage hole b6 by the side of the induction current collection coil 11 (side with small spacing of the superconduction coil 7 and the inside wall of an inner lift 3) (side with large spacing of the superconduction coil 7 and the inside wall of an inner lift 3) is enlarged. Therefore, even if it arranges the superconduction coil 7 off center within an inner lift 3, since the refrigerant passage hole a5 is sufficiently large, sufficient flow rate of the refrigerant to each part of the inner lift 3 interior can be secured, and maintenance of the stable superconducting state is attained.

[0013] at this time, the superconduction coil 7 carries out eccentric contiguity of the spacer metallic ornaments 4 by the side of the induction current collection coil 11 -- the cross section -- decreasing -- in addition -- and it is also considered enough that the whole super-conductive magnet 1 rigidity falls by processing the refrigerant passage hole b6, and generation of heat by vibration goes up. Then, board thickness of the spacer metallic ornaments 4 by the side of induction current collection coil 11 close attendants is thickened, and rigidity is made to increase, as shown in drawing 2 . Moreover, in order to make rigidity increase more, there is the approach of thickening only board thickness, without processing the refrigerant passage hole b6.

[0014] The outside tub 2 which holds the inner lift 3 which carried out the interior of the superconduction coil 7 according to above-mentioned this example, Since the induction current collection coil 11 was attached in the field which counters the surfacing coil 14, and eccentricity of the superconduction coil 7 was carried out to the side near the induction current collection coil 11 in the inner lift 3 and it has arranged It became possible to perform stable current collection, could dedicate spacing of the surfacing coil 14 and the promotion coil 15 which have been arranged on the ground, and the superconduction coil 7 to a necessary distance, and maintaining the required surfacing force and driving force.

[0015] Furthermore, since according to this example unification of the outside tub 2 and the induction current collection coil 11 with which the superconduction coil 7 is dedicated is attained and the equipment only for current collection (said drawing 5 , superconduction coils 21a-21d for current collection of drawing 6) is not needed like the conventional example, reduction of car weight is attained and it leads to the increment in a transportation number of passengers.

[0016]

[Effect of the Invention] It becomes possible to maintain a stable electric power supply and a stable superconducting state, securing the space in which an induction current collection coil is installed, when collecting power to ground side empty vehicle both sides using the electromagnetic-induction phenomenon between the surfacing coils by the side of the super-conductive magnet for maglev trains carried in the car, and the ground according to this invention.

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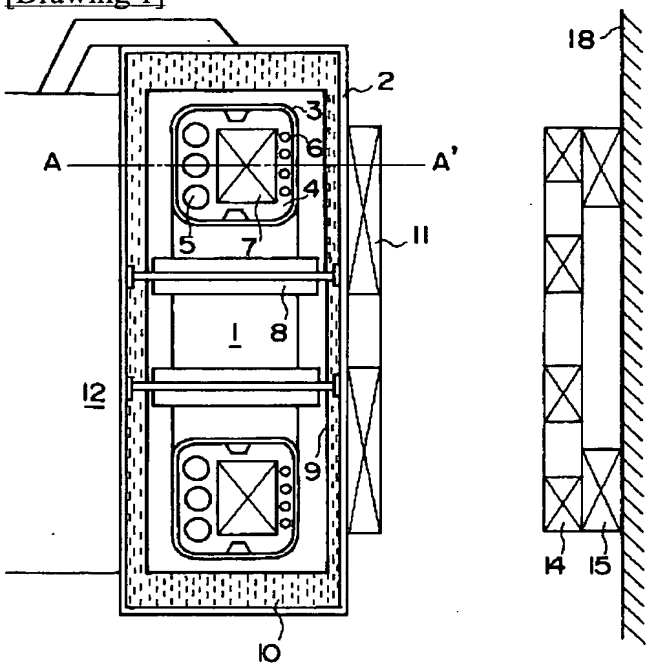
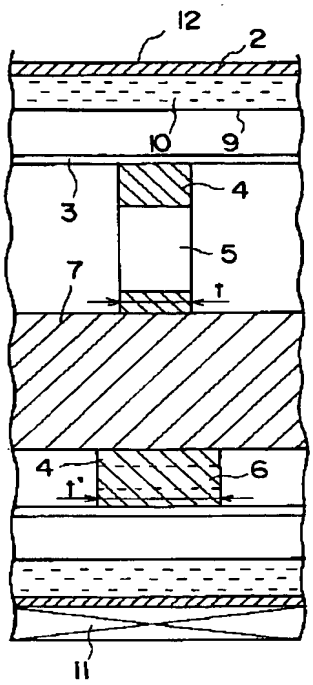
DRAWINGS

[Drawing 1]



1：超電導磁石　2：外槽
3：内槽　4：スペーサ金具
5：冷媒通過穴a　6：冷媒通過穴b
7：超電導コイル　8：荷重支持材
9：窒素シールド板　10：断熱材
11：誘導集電コイル　12：台車
13：地上側の側壁　14：浮上コイル
15：推進コイル

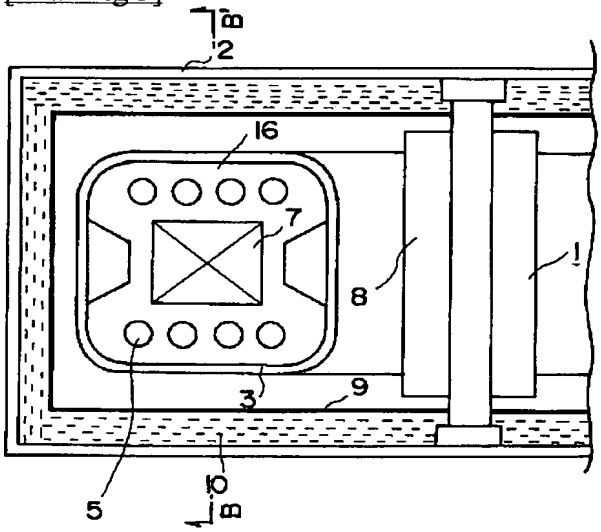
[Drawing 2]



(図1A-A'断面)

スペーサ金具板厚 t<t'

[Drawing 3]



16：金具

[Drawing 4]

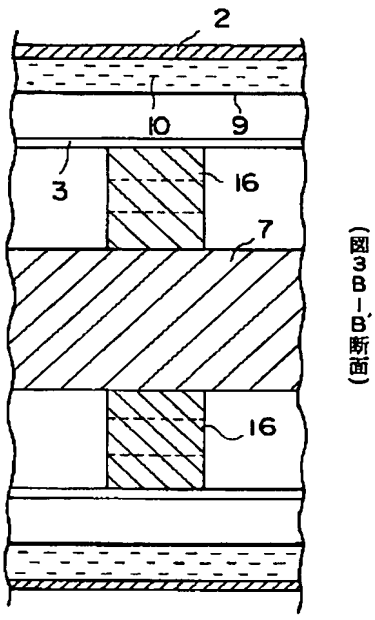
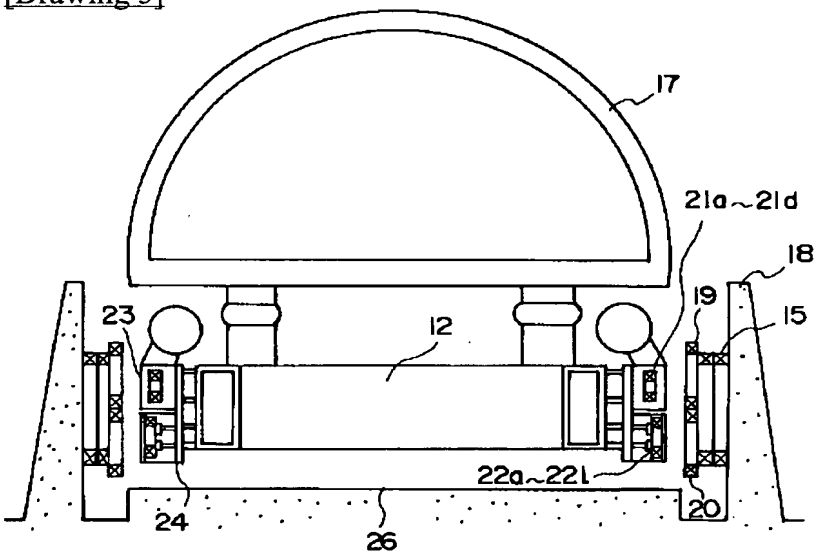
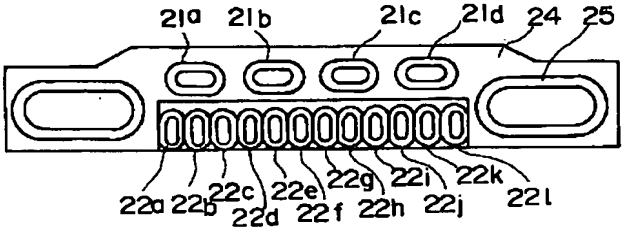


図3B-B'断面

[Drawing 5]



[Drawing 6]



１７：車体
１８：側壁
１９：第１の浮上コイル
２０：第２の浮上コイル
２１ａ～２１ｄ：集電用超電導コイル
２２ａ～２２ｌ：誘導集電コイル
２３：クライオスタット（外槽）
２４：支持部材
２５：浮上推進用超電導コイル
２６：軌道

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